MARINE REVIEW.

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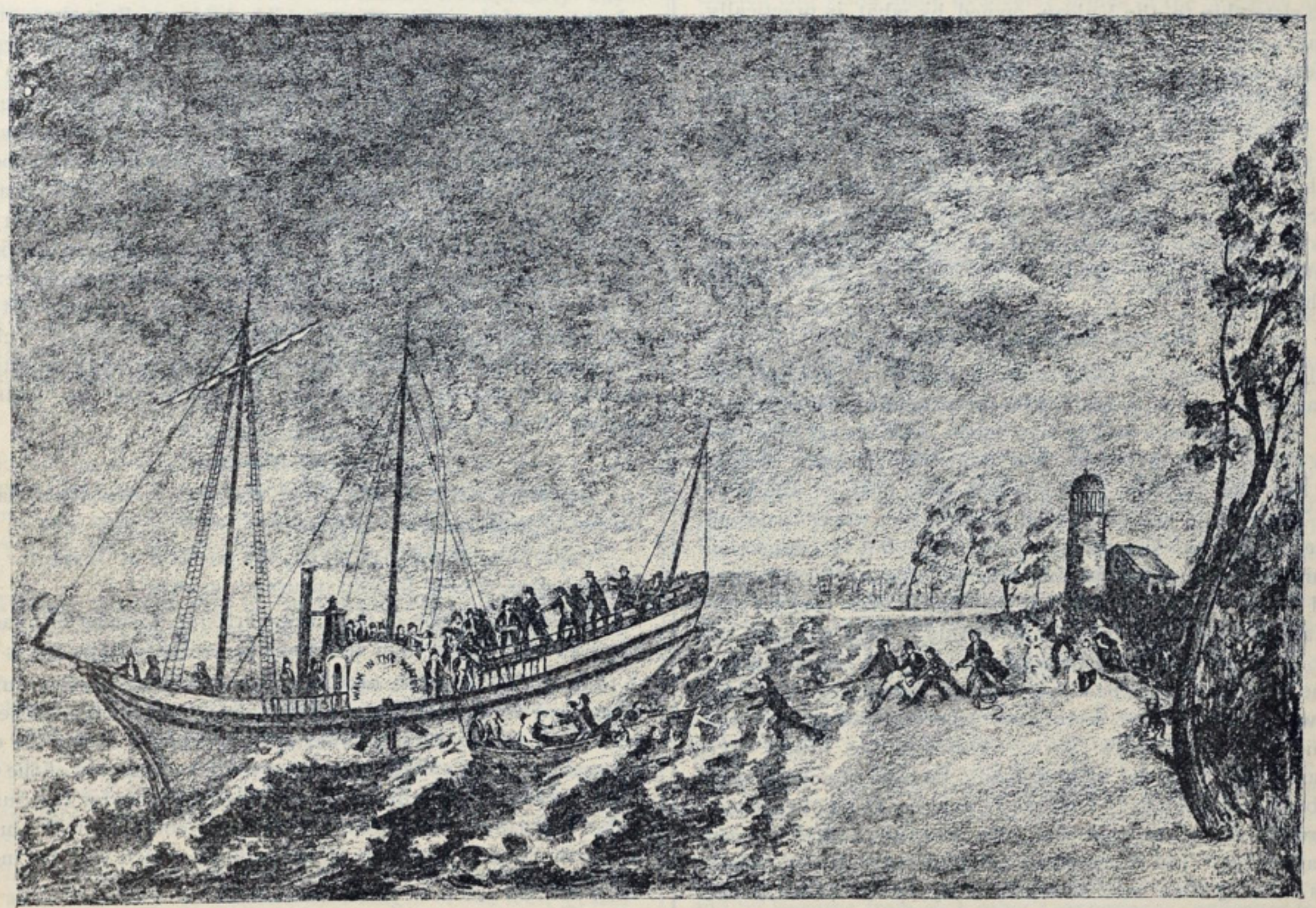
Iron Ore Market—Lake Freights.

Only a few years ago the consumption of Bessemer iron ore in this country was about one-third of the total consumption, but just now the consumption of Bessemer is two-thirds of the total and the non-Bessemer one-third. This may seem like an over-drawn statement but it is nevertheless true, and it is largely on account of this change in conditions that the Bessemer ore producers of the Lake Superior region who are still holding standard grades for $4 a ton, or better, feel that they will win against the efforts of the Carnegie and Illinois steel companies to buy at a lower price. The buying movement that was started some ten days ago among furnace men independent of the two big companies has not resulted in the purchase of more than 750,000 tons at the outside, according to conservative estimates, but this aggregate of sales is enough to indicate the general feeling among furnace owners, who will certainly loose no time in buying when the two big companies come into the market, no matter what the price may be. The past few days have developed another period of inactivity on the part of smaller owners of furnaces, who are not following up the first purchases but are again awaiting the action of the leading steel makers. It is a matter of great surprise to the ore dealers that such is the case, as conditions favorable to higher prices for iron continue to increase. There is not enough pig iron in the country today to meet the consumption for ten days if all furnace men were out of blast, and although the market for Bessemer pig has not gone above $14.20 to $14.25 during the week; the feeling is very strong with everything practically sold up for sixty days ahead. In addition to all this there is certainly a probability that a spurt in the iron market may yet cause ore to sell at prices equal to those of a year ago.

These are facts that cause the ore producers to feel unusually firm in the position they have taken and hopeful for even more than their present demands, but they have not sold enough ore to warrant arrangements for lake freight contracts, and it is probably well that such is the case, as under present conditions they would certainly insist that $1.15, or 10 cents less than last year, should be the maximum season rate from the head of Lake Superior, with Escanaba and Marquette rates reduced accordingly. The ore men feel that they can get little tonnage at such a price, however, and this is one of the principal reasons why they are holding out against sales of ore at low prices.

Several shippers of soft coal have tried during the past few days to make contracts for tonnage for the head of Lake Superior for large blocks running throughout the season at less than 50 cents, but such offers have been refused by the vessel owners in all cases. Rates offered on blocks of coal to go to Gladstone, Escanaba and other Lake Michigan ports are also lower than the average for last season, notwithstanding the certainty of an immense coal movement, but all vessel owners fear big losses in such contracts, even at last season's rates, and will



WRECK OF THE WALK-IN-THE-WATER, FIRST STEAMER ON LAKE ERIE. (For description see page 7.)

avoid tying up their boats on freight rates that are at all doubtful. The fleet of lumber carriers and other small boats that engage in the coal trade between Ohio ports and ports on the Detroit and St. Clair rivers will get only last season's freight at the opening, as a few vessels of this class have been engaged to load at Cleveland for Amherstburg at 25 cents. A few charters for first trips have been made at 45 cents to Gladstone and Escanaba, 50 cents to the head of Lake Superior and 55 cents to Green Bay, Chicago and Milwaukee. The 50 cent coal rate will very probably be paid to any boats that will go direct to the head of Lake Superior from Ohio ports on the opening but coal shippers will delay charters on any of the boats bound down with grain from Chicago, in an effort to reduce the Lake Superior rate.

Launch of the Vega.

There will probably not be launched from lake ship yards this spring a more economical freight carrier than the steamer put into the water at the Globe Iron Works Company's yard, Thursday afternoon, for the Vega Transportation Company. She is a sistership to the Vulcan, owned by what is practically the same company and said to be a money maker. The Vega is 286½ feet keel, 302¼ feet over all, 38 feet beam and 24 feet deep. Her engines are compound, 27 and 50 inches by 36 inches stroke. Steam at 115 pounds pressure will be furnished by two boilers of 9 by 14 feet. She will have two spars and will be fitted with a Globe steam steerer, steam capstan windlass and capstan. She will be commanded by Capt. Frank Brown, and Charles Sterling will have charge of the engines. Capt. Brown superintended her construction. Miss Mary B. Crowell christened the steamer.

Marine Engineers' Wages.

Below is presented a table showing English, American and lake marine engineers' wages. The comparisons are quite interesting. The American wages are taken from boats like the Illinois, there being but very few American Atlantic freight liners, and the English are computed from boats of the same class. The column marked special, shows the wages paid on such steamers as the Teutonic, Majestic etc. But in connection with this column it should be remembered that a liberal bonus is paid to the engineer staff at the end of the year for efficiency and discipline in their departments. This amounts to from 10 to 15 per cent. of their wages, and would in connection with the English wages be equal to what the special American wages would be if there were any American boats like the Teutonic, Majestic or New York. Although the lowest lake wages are given, only the highest should be used in comparison, as the boats on which $125 a month is paid to the chief engineer are more like the boats from which the English and American wages are taken. But it should be remembered that with eight months running time and a month to lay up and fit out in the lake engineer is employed only nine months out of a year. Some of the line steamers, however, find it profitable to keep part of their engineer staff at work all the year, the Lehigh line having kept twenty eight men at work on engines of their boats this winter. It has been stated that the International line retained the English engineers because they would work cheaper than American engineers, but with the bonus, the English-Americans seem to be getting pretty fair wages.

WAGES OF ENGINEERS PER MONTH.

	American.	English.	Special.	Lake.
Chief engineer	$112 50	$105 00	$150 00	$100 to $125
First assistant	75 00	75 00	100 00	
Second "	65 00	60 00	70 00	60 00 " 80
Third "	55 00	50 00	60 00	
Juniors	45 00	45 00	50 00	37 50
Firemen	40 00	25 00	25 00	37 50
Coal passers	35 00	22 50	22 50	

Cargo and Hull Insurance.

Again the underwriters have cut all previous rates on cargo insurance, and in the scramble to secure business the shippers of coal and iron ore are offered insurance at figures that are very low. This business is done on blanket policies covering all shipments for the season. On coal the rates generally offered are 14 cents to Lake Michigan and 15 cents to Lake Superior, but some of the larger shippers claim that they have under consideration proposals that involve rates even better thau these. One company that had a rate last season of 14 cents on about 1,000,000 tons of ore, covering both Lake Michigan aud Lake Superior ports, has closed its business for the coming season at a rate that shows a marked reduction over last year.

Contrary to expectations the steel boats on which Inspector Herriman has been at work for several weeks past will not be noted in the new register according to the several grades agreed upon a short time ago. Capt. Herriman has inspected about seventy of 126 steel vessels on the lakes and will continue the work throughout the season. The underwriters will all have advantage of the information which he has collected regarding these vessels, but a classification of them in the register according to new plans will not be made until next year.

Although the printed tariff of rates for hull insurance has not as yet been distributed, it was understood immediately following the meeting in Chicago last week that there will be no changes in rates, but in place of restricting the April rebate to fifteen days, a rebate of 3 cents is to be granted for every six days not used in that month. Instead of five-day extensions of insurance after the expiration of policies, the December extensions are to be charged up for per diem when granted. It has also been decided to waive the "one-third new for old" clause covering repairs of wooden vessels on payment of an addltional preminm of 20 cents for vessels of A1 grade and 30 cents for vessels of A1½ grade.

Personal Mention.

Secretary Keep, of the Lake Carriers Association, has returned to Buffalo from a trip south.

Capt. John Perew has taken the position of inspector with Worthington & Sill, Buffalo insurance agents.

President Wilson of the Lake Carriers' Association has returned to Cleveland from an extensive southern trip.

Mr. T. G. Worden of Columbus, president of the Sunday Lake Coal Company, made arrangements in Cleveland Tuesday with W. A. Canfield for the chartering of vessels during the coming season. Mr. Canfield looks after the lake business of the Ohio Coal Exchange and will act in a similar capacity for the Sunday Lake company. Shipments of the latter company will amount to about 150,000 tons, the great bulk of which will be moved from Toledo.

Proposals for Dredging.

Proposals for dredging in Cleveland, Fairport, Ashtabula, Huron and Port Clinton harbors, at the mouth of Black river and in Sandusky river, and for the extension of piers and other improvements at Huron were opened at the office of Col. Jared A. Smith, United States engineer, Cleveland, Monday. The pier work at Huron was secured by Q. Gilmore of Lorain, O., at 65 cents per cubic yard for dredging the cuts, $22.50, $33, and $35 per thousand for hemlock, white pine, and white oak timber, $5.50 per cord for stone, 4 cents per pound for iron plates, spikes and screws, and 3½ cents for drift bolts. On all of the dredging Sadler & Allen of Detroit were the lowest bidders. They agreed to take the Cleveland work at 14 cents, Sandusky and Port Clinton at 16 cents, Fairport and Ashtabula at 20 cents, and Huron at 25 cents.

In the article in last week's REVIEW, headed "High Pressure Boilers," the diameter of the Serve's tubes used was 3¼ inches outside and not 2¼ inches as printed. Ribbed tubes are not manufactured in steel as small as 2¼ inches, and if they were they would not be applicable for use in marine boilers.

Wreck of the Walk-in-the-Water.

The illustration on page 5 is presented as an ancient work of art. It is copied from an oil painting by Mr. Matthies, made for the parents of ex-Senator Thomas W. Palmer, who were on the boat when she was wrecked, returning from their wedding trip. The apparent perspective, giving one the idea that the shipwrecked passengers might have jumped ashore from the stern, and the figures in the water, indicating that those who could not get into the life boat walked ashore, detract from the seriousness of the disaster.

The Walk-in-the-Water was built at Black Rock, now part of Buffalo N. Y., in 1818 and was the first steam vessel that ever navigated any of the lakes above Ontario. She was launched May 28, 1818, and started on her first trip from Black Rock to Detroit on Aug. 25 in the same year. Her machinery had to be brought from Albany to Buffalo, a distance of 300 miles, in wagons drawn by five to eight horses each. As this vessel ran regularly to and from Black Rock harbor and not to the present harbor at Buffalo, she had to proceed a short distance down the Niagara river. While she could navigate down stream safely, her power was not sufficient to enable her to make headway against the strong current at the head of the Niagara river. Resort was therefore had to what was known in the early days as a "horned breeze." The Walk-in-the-Water was regularly towed up the Niagara river by a number of yokes of oxen.

The boat made her trips regularly between Black Rock and Detroit, making the round trips in nine to ten days. She was wrecked and lost on the beach at Buffalo in November, 1821, but during the winter of 1821–'22 a second steamer was built at Buffalo named the Superior. The machinery of the Walk-in-the-Water was used in the Superior. It was a low-pressure engine, 48 by 40 inches, and turned 16-foot paddle wheels. The hull was 150 feet long by 27 feet beam, and she was described as "the finest steamer in the world except one recently launched in New York, designed to cross the Atlantic." Job Fish was her first captain.

Any of the readers of the REVIEW who wish to preserve the picture can have a copy on plate paper, without reading matter by sending their address to this office.

Around the Lakes.

Soundings over the bar outside of Ashtabula harbor are said to show 17 feet, more water than for several seasons past.

The new steel steamer Arthur E. Orr will be launched from the yard of the Chicago Shipbuilding Company in about two weeks.

We have received with the compliments of George T. Marks copies of annual reports of the boards of trade of Port Arthur and Fort William, Ont.

Contracts for the five lake lightships, on which the Craig Ship Building Company of Toledo submitted the lowest proposal, have been awarded to that company.

Trunk line managers propose to divide the east-bound traffic in grain delivered to them by boat at Erie and Buffalo for the seaboard. Such a pool should help the Erie canal boat owners.

The wooden steamer which P. F. Thrall is preparing to build at Green Bay will have a keel length of 164 feet, 35 feet beam and 12 feet hold, with an estimated carrying capacity of 800,000 feet of lumber.

We are informed by the Jenks Ship Building Company of Port Huron, that there is no truth in the report of a sale of one of their new steamers to Chicago parties. The company still has three lumber steamers for sale.

The propeller H. D. Coffinberry now in Cleveland, which was arrested by the United States marshal on March 1, on a libel filed by the Detroit Dry Dock Company, will be sold at auction at the government building on Tuesday next.

James Churnley & Co. have sold the steamer John Otis to Capt. James Sandford and others of Muskegon for $14,000. The Smith-Fee Company has purchased the steamer Otego, now at Buffalo, and will run her between Duluth and Portage lake.

On the river front property of A. Smith at Algonac, A. W. Comstock, lumber dealer, is building a lumber steamer of 800,000 feet capacity, and it is intended as soon as she is launched to lay the keel for another steamer of obout 1,000,000 feet capacity. The boat now on the stocks will be launched in a few days.

Iron Mining.

VALUE OF LEADING STOCKS.

Quoted by Chas. H. Potter & Co., No. 104 Superior St. Cleveland, O.

Stocks.	Par Value.	Bid.	Asked.
Cleveland-Cliffs Iron Company	$100 00	$ 53 00	$.....
Champion Iron Company	25 00	26 00	.....
Chandler Iron Company	25 00	.....	40 00
Jackson Iron Company	25 00	.....	75 00
Lake Superior Iron Company	25 00	28 00	31 00
Minnesota Iron Company	100 00	60 00	63 50
Pittsburgh & Lake Angeline Iron Co	25 00	.....	137 50
Republic Iron Company	25 00	.....	9 75
Ashland	25 00	.....	.....
Section Thirty-three	25 00	1 00	.....
Brotherton	25 00	.....	.....
Iron Belt	25 00	2 40	2 75
Aurora	25 00	6 50	7 00

Lake Superior mine managers to the number of about 150 organized at Iron Mountain, Mich., last week, a society to be known as the Lake Superior Miners' Association. The object is the same as that sought by similar organizations in the mining industry in this and other countries. At a session lasting through three days of last week, papers were read, permanent officers elected and visits made to several mines in the vicinity of Iron Mountain. At the Chapin mine the visitors inspected the big pump, which is the largest in the west and which is reported to cost $300,000. In addition to this big pump, the Chapin company is figuring on another pump, to have a capacity of 2,000 gallons per minute, lifting it 1,500 feet. The bailing process at the Hamilton-Ludington was also examined. The bailers were worked to show how quickly and easily they performed the task. These bailers are 43 feet long, are made from old boiler shells at small cost, and hold ten tons of water, or about 2,700 gallons. They are operated so as to remove 2,000 gallons of water per minute. Officers elected by the association are: President, Nelson P. Hulst of Milwaukee; vice presidents for two years, J. T. Jones of Iron Mountain, F. P. Mills of Ishpeming, and Graham Pope of Houghton; vice presidents for one year, M. W. Burt of Ironwood and J. Parke Channing of Iron Mountain; board of managers for two years, Walter Fitch of Champion and John Duncan of Calumet; board of managers for one year, J. N. McNaughton and Chas. McGregor of Iron Mountain, and Wm. Kelly of Vulcan; secretary, F. W. Denton of the Michigan Mining School; Houghton; treasurer, C. M. Boss of Bessemer.

Two papers were read at the meeting, one on "Soft Ore Mining by Per Larrson of the Aragon mine, and the other on "The Geology of that Portion of the Menominee Range East of the Menominee River," by Dr. Nelson P. Hulst of Milwaukee. Mr. Hulst's paper was very interesting, and was accompanied by maps of the range and of several mines showing the geological formation. Four methods of mining made use of in Lake Superior soft ore mines—stripping and open pit work, rooming with timbering, filling and caving—were all described in the paper by Mr. Larrson, who concluded by saying that the conditions that meet the miner in the different mines are so varied that no two mines can be worked by exactly the same plan. "Such of us that have had pet methods are fast giving them up," he added, "and we would perhaps all be only too glad to join our Mesabi friends in adopting their stripping proposition, if nature had not turned our ore deposits edge-ways in the ground. We must, however, adapt ourselves to the conditions that meet us and by learning from each other's experience, endeavor to keep ourselves to the front among American miners."

Two regular meetings will be held annually, on the first Wednesdays in March and December. The next meeting will be held in Ishpeming. Any person in any way interested in mining is eligible to membership on the recommendation of a member of the association and the approval of the council. The annual membership dues are fixed at $5.

The Merrett-Rockefeller combination is said to have paid to the Lake Superior company for its leases on 4,000 acres of Mesabi range lands $250,000, of which $100,000 is to be turned over on delivery of the leases and the balance in five installments to extend over eighteen months without interest. The Lake Superior company will also receive one-half of the net profits from the sale of ore. The Chicago & Minnesota Ore Company, now controlled by the Minnesota Iron Company, is reported to have taken options recently on immense tracts of Mesabi land.

The new steamer now being constructed in England for the Montreal Transportion company will be called the Bannockburn,

Will the Harter Law Displace Collision Insurance?

The last Congress passed a law known as the Harter law and relating to contracts of common carriers. Secretary Keep of the Lake Carriers' Association went to Washington to look after this act and, upon his return, made a report to the association, in which he referred to the law as being very liberal to the vessel owners, and such is evidently the case, as it is provided that where a vessel owner has exercised due diligence to make his vessel seaworthy and properly to man and equip her, he shall not be liable for loss or damage to the cargo from any fault or negligence in navigation or management of the vessel, unless it be the fault or negligence of the ship's owner or manager. Before the passage of this law, an insurance company having a risk on a vessel's cargo, and becoming subrogated to the rights of the cargo owner against the vessel, might enforce claims against the vessel owner. Now, according to Mr. Keep's version of the law, such claims by cargo owner can not be enforced where the owner has exercised due diligence in equipping and manning his boat. This is all right as far as the cargo is concerned, but there are some vessel owners and underwriters who are of the opinion that the law goes even further and protects the owner against enforcement of claims for any damage that may be inflicted upon another vessel under like circumstances. It will readily be seen that if such is the case, the owner who prepares his vessel properly for a voyage will find no need of paying for insurance for his vessel against collision liability. This side of the question was referred to recently by Mr. Henry S. Sill, of Worthington & Sill, Buffalo, who makes the following reply to the REVIEW in answer to a request for any information that he might have on the subject:

"I have yours of March 23 regarding the Harter bill. When I was in Cleveland I had a talk with some of the vessel owners there but do not know as I expressed my opinion in any decided way regarding it, except that it seemed to me an unjust bill, if the construction put upon it by our New York attorneys was right. It appears with some that, according to section 3 of the bill, if a vessel collides with another it can not be held liable for damage done, even though the damage was done through faults or errors in navigation. This applies to the damage to the hull as well as to the cargo. It would appear by Mr. Keep's letter that his construction was that it applied to the cargo only. My intent was to refer the matter to Mr. Goulder and get his opinion as to what construction he put on section 3 of the bill. While the bill in some cases might result to the disadvantages of the insurance companies, it would act to the contrary in others, so I do not think it makes any particular difference. But if the vessel owners are not liable for damages done by reason of errors of navigation, it might have some effect on our collision clause, which is attached to most of our marine policies. We do not think the matter has been made perfectly clear so that we could take definite action. Our New York attorneys write us that, 'neither the vessel nor her owners can be held responsible for damage or loss resulting from collision with another vessel, although caused by fault or error in navigation or in the management of the vessel.'"

The third section of the bill, to which Mr. Sill refers, and which is the only section that applies to vessels in the coastwise trade, is as follows:

"If the owner of any vessel transporting merchandise or property to or from any port in the United States of America shall exercise due diligence to make the said vessel in all respects seaworthy and properly manned, equipped, and supplied, neither the vessel, her owner or owners, agent or charterers shall become or be held responsible for damage or loss resulting from faults or errors in navigation or in the management of said vessel; nor shall the vessel, her owner or owners, agent or master be held liable for losses arising from dangers of the sea or other navigable waters, acts of God, or public enemies, or the inherent defect, quality, or vice of the thing carried, or seizure under legal process, or for loss resulting from any act or omission of the shipper or owner of the goods, his agent or representative, or from saving or attempting to save life or property at sea, or from any deviation in rendering such service."

Stocks of Grain at Lake Ports.

The following table, prepared from reports of the Chicago board of trade, shows the stocks of wheat and corn in store at the principal points of accumulation on the lakes on March 25, 1893:

	Wheat, bu.	Corn, bu
Chicago	15,743,000	6,041,000
Duluth	16,382,000	341 000
Milwaukee	1,993,000	13,000
Detroit	2,208,000	60,000
Toledo	3,669,000	1,736,000
Buffalo	2,102,000	87,000
Total	41,897,000	8,278,000

At the points named there is a net increase for the week of 485,000 bushels of wheat and 2,000 bushels of corn.

In addition to the above stocks, there was afloat in lake vessels at Chicago on the 18th inst. 4,576,000 bushels of wheat, 2,257,000 bushels of corn and 316,000 bushels of oats; at Duluth, 571,000 bushels of wheat; at Detroit, 310,000 bushels of wheat, and at Toledo 25,000 bushels of wheat.

Steam Capstans.

The steam capstans made by the American Ship Windlass Company of Providence, R. I., are earning quite a reputation as labor and expense saving machines. Such concerns as William Sellers & Co. and the Southwark Foundry and Machine Company have used these steam capstans in their yards for hauling coal, pig iron, sand, etc. for a number of years, and the Dabol Rubber Company, Bergenport Chemical Works and like establishments have used them for hauling cars in and out of their ovens, and switching them about their yards.

Lately the Pennsylvania Railroad Company ordered two of these steam capstans for switching cars in and out of their paint shops, and the Broadway and Seventh Avenue Railroad Company, New York, has just put one of them in its power house to be used for switching their cable cars in and out of the house.

A short time ago the American Steel Barge Company also put one of the capstans in its yard for hoisting and for switching cars, etc., and now F. W. Wheeler & Co. have just ordered two of the largest size steam capstans for use in their ship yards.

If it is true that a penny saved is a penny earned, then these steam capstans will continue to be called for in increasing numbers, as it is necessary in all branches of business now-a-days to save every dollar possible, and these machines will pay for themselves every season.

* Marine Engine Design—Valve Gears.

(*Continued from Vol. 7 No. 10.*)

The design of a valve gear in detail involves a complete examination of the various points of steam distribution among the cylinders, consideration of which has been already omitted as unsuited to the elementary character of these articles. A general estimate of the advantages and disadvantages of the principal types of valve gear may, however, not be without interest.

The function of the valve gear is to so distribute the steam to the various cylinders as to provide for the continuous working of the engine in the desired direction. The main points to which attention is necessary are that provision must be made for reversal and for varying expansion within certain limits, while the distribution must be such as to insure smooth mechanical working, fair equalization of work among the cylinders, and as nearly as may be continuous expansive action of the steam. For any given cylinder, eight operations are to be provided for, viz, steam and exhaust opening and closure for each end. In the forms of valve gear having indepentent cut-off, the steam and exhaust functions are separated, each being performed by a valve and mechanism appropriate to the end desired. Of late,

* Written for the MARINE REVIEW by W. F. Durand, principal of Graduate School of Marine Engineering and Naval Architecture, Sibley College, Cornell University.

with the increasing tendency toward lightness and simplicity of moving parts, and with the introduction of special forms of valve gear and piston valves, the whole distribution is quite commonly assigned to one valve. This requires various sacrifices in other matters, which, however, are undoubtedly justified by the saving in weight and complication. In truth, the whole engine from beginning to end is a bundle of compromises, special sacrifice being justifiable here and there in order to bring the all around efficiency to the desired point. Some of the sacrifices thus introduced by the simplification of valve gears are:

1. The steam distribution is less perfect, having regard to thermodynamic efficiency and mechanical smoothness of running.

2. The practicable range of variable expansion is decreased, and points of cut-off much earlier than half stroke are attended with either prohibitive compression, or inadmissably early release.

3. The subdivision of work among the cylinders is liable to be less perfect with the necessary restriction in cut-off in the high pressury cyliuder.

In illustration of the last point, it may be noted that in a triple expansion engine such as has been previously assumed, the number of expansions in the high pressure cylinder in order to give fair equalization of the work without excessive cushioning or drop would be about two as taken. With a clearance volume of from 10 to 15 per cent. as is common with piston valves, this would require a cut-off considerably before half stroke. With a Stephenson link and one valve this would be impracticable, and if therefore, such form of gear is adopted, we must be content with cut-off at half stroke or later, and with an expansion of 1.5 to 1.7 times. A little thought will show that this throws an unduly large number of expansions into the two steps between the high and low pressure cylinders. With a given size of low pressure cylinder, this results in an unduly small size for the high pressure cylinder, with a correspondingly small amount of work developed. This is one of the principal causes of the tendency toward an excess of work in the intermediate and low pressure cylinders noticeable in engines designed with such proportions.

Of the various types of valve gear appropriate for the control of a valve which is to perform the entire distribution, the Stephenson link is the most widely used and the best known, though of late various forms of the so called "radial" type of valve gear have been widely adopted. With the general theory of the action of valve gears we are not here concerned. It may suffice to say that for any of these gears in any configuration, it may be shown that the motion given to the valve is, more or less approximately, the same as would be given by a single eccentric of a certain angular advance and a certain throw. This is called the equivalent or virtual eccentric, and the reverse mechanism is simply a means for so modifying the configuration, that the angle of advance is changed from one side of the crank to the other, thus reversing its relation to the crank and effecting the reversal of the engine. Similarly the gradual linking up may be shown to decrease the throw and increase the angular advance of this virtual eccentric, thus bringing about the well known results of earlier cut-off and decreased travel.

We may briefly characterize the Stephenson link by stating that the motion for the valve is taken from a block moving in a slotted link, or kinematic equivalent, the said link being guided at one point in a definite circular arc by means of the suspension bar, and receiving motion at two other points from two eccentrics by means of eccentric rods. The change in configuration for varying cut off and reversal consists in varying the mean position of the block within the link. If it were not necessary to take hold of the link by the suspension bar for purposes of ready reversal, the block might be secured temporarily fast to the link and would therefore move without slip. Were the link so guided, we should have one point traveling in a straight line, and other points in general tracing closed curves, departing, according to their location, more or less widely from a straight line path. The point intended to be used for suspension would, in general travel in one of these curves. If therefore, vice versa, this point be forced to travel in a circular arc, it follows that the point where the block was cannot travel in a straight line, and that between the link and block there will be a certain amount of slip, depending on the difference between the curve and the circular arc. This slip, which is always found in greater or less degree in the Stephenson link, should be rendered a minimum, though if really desired, its influence on the movement of the valve may be utilized to equalize the cut-off or port opening on the two ends of the cylinder. For the diminution of slip, it will be found that much may be done by a proper choice of the point of suspension on the link, and of the center of suspension for the bar. In general it will be found that the center of the link is the best point for it's suspension, and that the bar should be turned away from the link block in the go ahead position. The proper positions and dimensions must be determined from a model of the gear, or by laying down on the drawing board the various positions taken by the gear in the course of a revolution. By such means the slip in the go ahead position may be rendered very small. In the backing position it will be considerably greater. Such an arrangement, however, seems perferable to an attempt at equalization of slip or the two positions. These points, however, can only be satisfactorily presented in connectlon with the complete design of a Stephenson link and gear.

In general we may consider the Stephenson link valve gear as furnishing a good average combination of the various qualities necessary. This together with the favorable distribution of the strains received by the gear, and its all around reliability, have made it a favorite for general marine practice. The general advantages of radial gears over the link are as follows:

1. With proper proportions, the quick and slow movements of the valve may be so arranged as to give fairly quick opening and sharp cut-off, with slow intermediate motion.

2. They allow of a somewhat wider range of expansion without the derangement in exhaust opening and compression which result in a similar case by the use of the link.

3. They give a constant lead for all ranges of expansion.

4. They bring the valve chests on the thwartship sides of the cylinders, and more or less completely do away with the use of eccentrics. This shortens the length of the engine over all, and brings the crank shaft bearings close up to the cranks, thus giving greater strength and stiffness.

Their relative disadvantages may be noted in connection with a few of the representative types. In the Hackworth gear, the friction of the sliding block in the slotted link is apt to be excessive, and in extreme positions serious strains come on the various parts, rendering it necessary to make the various pins and bars of large size to provide the necessary strength and stiffness. The friction may be decreased by fitting rollers instead of the block, but in such case the wear on such parts will be excessive. This gear has the general good properties of the radial type, with equally good distribution for both backing and going ahead directions.

In the Marshall or Braemme gear, the sliding block and guide are replaced by a swinging arm pivoted on a center whose location may be varied for varying cut-off and reversal. The friction of the block is thus avoided, but the various parts must be strongly proportioned to withstand the strains which in certain positions are liable to come upon them. With this gear the distribution for the backing position is less perfect than for the ahead, and in order to obtain equal port opening on each end, it is frequently necessary to provide double ports on one end with single on the other. With the Joy gear we have the various advantages possessed by radial gears in general, with the entire absence of eccentries, but at the expense of a large number of working parts. Wear in these parts may seriously interfere with the proper action of the gear, and for this reason and to withstand the strains, especial care is necessary in the proportions of the parts. In this gear we may have either the block or the slotted bar guide, or the swinging bar as in the Hackworth and Marshall gears. With the first the distribution is equally good in both directions; with the second this is not the case, and in addition it may be desirable to fit double ports on one end with single on the other.

In various other forms of special valve gear, the ends desired are obtained at an expense of greater or less complication of parts. Simplicity is certainly one of the requirements for an ideal valve gear, and for marine purposes especially, the value of slight advantages should be very rigidly scrutinized before they are to be considered as worth the additional complications necessary to their attainment. It must be remembered that preeminence in some one or two particulars is not what is needed but rather such a just admixture of desirable qualities that the end desired shall be obtained with the mininum expenditure of the ultimate sources of human activity, viz., human time and energy, the energy of nature, and the materials of construction.

As to just which of the various existing forms of valve gear the most nearly fulfills these requirements for any given set of conditions, judgement based on experience can alone determine. It is, however, quite certain that all of these are far from ideal, and there is therefore opportunity for an indefinite series of inventors and improvers, through whose efforts we may hope to see more nearly the ideal conditions attained.

MARINE REVIEW.

DEVOTED TO THE LAKE MARINE AND KINDRED INTERESTS.

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ON next Thursday General Poe and the board of army engineer officers intrusted with the duty of investigating raft towing on the lakes will receive written arguments on the subject at Detroit. The vessel interests, through the Lake Carriers' Association, should give this meeting earnest attention. A meeting of the lumbermen was held a few days ago and they will be heard from by the engineers. There was rafted to Saginaw river and Tawas bay last season 185,000,000 feet of logs, and a good many million feet were rafted from the north shore and from Canada to Cheboygan. A number of million feet were rafted from Presque Isle to Alpena, and Alger, Smith & Co. have rafted from Black river an average of 90,000,000 feet a year the last ten years. A good many long logs have also been rafted from Saginaw bay points to the St. Clair river. The inauguration of the Canadian log rafting industry has invested the subject with considerable of interest to eastern Michigan lumbermen, and they will make a bitter fight against cutting down the size of the rafts. The business should be regulated, however, and it will be if the arguments in favor of certain necessary restrictions are properly presented.

CAPT. S. S. CURRY, president of the Metropolitan Land and Iron Company, owners of the great Norrie mine, was in Cleveland for two or three days recently. Capt. Curry was one of the pioneers in the Lake Superior mining region. He is now the leading spirit in the management of the greatest iron mine in the world, but he has not gained this position of prominence without meeting with some of the drawbacks so common to mining business. He was among the prospectors in the district surrounding Ishpeming, Mich., when that country was a wilderness, and his success, which began with the old New England mine near Ishpeming, was due to perseverence and a disposition marked with good spirit under all circumstances.

ALTHOUGH transportation rates on season freight contracts may be a little below last year's figures, it is probable that the thousands of engineers, sailors and other employes on lake vessels will have no cause for complaint on account of any change in wages. As freight contracts have not as yet been made on iron ore, the wage schedule of the Lake Carriers' Association will not be prepared until about ten days hence, but it is the general opinion among the members of the finance committee of the association, who have this matter in charge, that the opening schedule of last season, which went into effect on April 5, will again be adopted.

F. W. WHEELER of West Bay City, Townsend Davis of Smith, Davis & Co. of Buffalo, M. Schrank of Ashland, Mr. Jones of the Turney Coal Company of Columbus, T. G. Worden of the Independent Coal Company of Chicago, J. J. H. Brown of Buffalo, Frank Hart of Marine City, J. R. Irwin of Fairport and G. P. Tener of Pittsburg were all in Cleveland during the past few days. Most of these gentlemen are visiting different lake ports with a view of fixing up business matters preparatory to the opening of navigation.

ANOTHER article from Professor W. F. Durand bearing on engine design appears in this issue. We are very thankful for the several installments of popular reading matter on this subject contributed by so high an authority.

The Big Chicago Grain Fleet.

With the opening of navigation a fleet of vessels carrying nearly 9,000,000 bushels of grain will leave Chicago for Buffalo and other lower lake ports. These will include some tonnage now going to Chicago from Milwaukee to load grain. Following is a full list of vessels now loaded in Chicago.

WHEAT LADEN.

Name of Vessel.	Cargo, bu.	Name of Vessel.	Cargo, bu.
Steamer Raleigh	55,000	Steamer A. G. Lindsay	56,000
" Lansing	75,000	" Wilson	80,000
" D. C. Whitney	60,000	" Argonaut	45,000
" Escanaba	50,000	" S. J. Macy	40,000
" J. H. Prentice	35,000	Boats of Lehigh Line	300,000
" St. Lawrence	78,000	" Anchor "	220,000
" Mecosta	70,000	Schooners Baltic	65,000
" Pasadena	75,000	" H. A. Kent	52,000
" F. W. Wheeler	72,000	" H. A. Hawgood.	75,000
" W. R. Stafford	35,000	" S. H. Foster	45,000
" City of Cleveland	70,000	" San Diego	52,000
" D. M. Wilson	35,000	" S. V. R. Watson	30,000
" Jno. B. Lyon	75,000	" J. A. Francombe	45,000
" Parks Foster	84,000	" Middlesex	42,000
" C. W. Elphicke	84,000	" Manitowoc	35,000
" W. F. Sauber	85,000	" Iron State	64,000
" Germanic	60,000	" Halsted	35,000
" J. H. Farwell	50,000	" Constitution	28,000
" W. H. Gratwick	72,000	" J. Godfrey	42,000
" R. L. Fryer	80,000	" B. W. Parker	80,000
" Tom Adams	80,000	" G. W. Adams	75,000
" Geo. T. Hope	75,000	" Walter Vail	48,000
" Brazil	100,000	" Aberdeen	65,000
" Servia	65,000	" Twin Sisters	52,000
" Niko	50,000	" J. H. Rutter	60,000
" H. A. Tuttle	75,000	" F. D. Ewen	60,000
" Quito	52,000	" J. C. Fitzpatrick	80,000
" H. W. Sibley	65,000	" D. Vance	50,000
" City of London	86,000	" E. A. Nicholson.	50,000
" J. E. Owen	70,000	" Alverson	50,000
" F. E. Spinner	35,000	" H. W. Sage	50,000
" City of Venice	100,000	" Chas. Foster	64,000
" Siberia	73,000	" Sunrise	28,000
" Wm. Edwards	50,000	" John Shaw	60,000
" Pickands	70,000	" J. B. Merrill	42,000
" F. C. Bielman	85,000	" T. L. Parker	42,000
" A. Folsom	42,000		

CORN LADEN.

Name of Vessel.	Cargo, bu.	Name of Vessel.	Cargo, bu.
Steamer Geo. W. Morley	50,000	Steamer Iosco	90,000
" City of Paris	92,000	" Britannic	60,000
" Samoa	54,000	" P. J. Ralph	50,000
" R. R. Rhodes	75,000	" Bulgaria	80,000
" Iron King	70,000	Boats of Ogdensburg Line	120,000
" John Oades	60,000	Schooner E. B. Maxwell	25,000
" W. A. Avery	70,000	" Red Wing	48,000
" R. Richards	35,000	" Iron Cliff	65,000
" Minneapolis	55,000	" J. G. Blaine	38,000
" C. S. Parnell	75,000	" B. F. Bruce	50,000
" Iron Chief	60,000	" R. B. Hayes	50,000
" Neshoto	86,000	" Churchill	65,000
" John Craig	90,000	" Tasmania	65,000
" C. A. Eddy	85,000	" F. L. Danforth	48,000
" E. C. Pope	125,000	" Ashland	80,000
" I. H. Owen	90,000	" Wayne	55,000
" Neosho	85,000	" Iron Queen	70,000
" P. D. Armour	80,000	" Iron City	50,000
" J. F. Eddy	72,000	" Lem Ellsworth	22,300
" C. B. Lockwood	95,000	" Tokio	75,000
" W. M. Egan	75,000	" M.Slauson	20,000
" Jno. Plankinton	80,000	" American Union	34,000
" Louisiana	85,000	" Jas. Mowatt	38,000
" R. P. Fitzgerald	75,000	" J. J. Barlum	80,000
" J. C. Gilchrist	85,000	" N. A. Eddy	80,000
" Uganda	90,000		

FLAX LADEN.

Name of Vessel.	Cargo, bu.	Name of Vessel.	Cargo, bu.
Steamer Iron Duke	55,000	Schooner J. I. Case	50,000
" Caledonia	90,000	" O. Jeannette	75,000
" A. A. Parker	75,000	" B. Whitaker	65,000

OATS LADEN.

Name of Vessel.	Cargo, bu.	Name of Vessel.	Cargo, bu.
Steamer Roumania	125,000	Steamer G. F. Williams	120,000
" City of Rome	120,000	Schooner Lake Forest	27,000
" Hiawatha	75,000		

Inventions of a Marine Nature.

Specially reported from Washington for the MARINE REVIEW.

493,901—Anchor by Eben T. Starr of New York City; filed April 11, 1892; serial number 428,619.

494,014—Screw propeller by Robert McGlasson of Selhurst, England; filed May 21, 1891; serial number 461,484.

494,024—Thrust bearing for propeller shafts by Hans C. Pederson of Brooklyn, N. Y.; filed July 20, 1892: serial number 440,597.

493,720—Machinery for pressing boats from sheet metal by William Heslop of Wakefield, England; filed May 2, 1892; serial number 431,491. The lower die is movable and is provided with a retaining plate to protect the edges of the metal sheet.

The "Soo" Line Steamers—Hard Coal Freights.

Special Correspondence to the MARINE REVIEW.

BUFFALO, N. Y., March 30.—The difficulties between Alex. McDougall and the "Soo" line had to leak out after all. It was known here quietly months ago that there was going to be trouble, but interested parties said that it would be best to keep quiet, for McDougall was too proud of his whalebacks to go into a lawsuit with the people for whom the Pillsbury and Washburn were built. It really looks as though this were true, for the prospect now is that he will take them back rather than fight. Even if he does that he will have to stand the loss consequent on their light carrying power. Had his scheme to capture the flour trade of the lakes succeeded he would have been glad of the chance, but now it is different. The "Soo" line is not expected to make any move towards getting more vessels till the whalebacks are off their hands. The demand for rebate comes so near to eating up the boats that it looks as though there was a determination to throw them up.

Our vessel men kick because Ohio has made such a low coal rate. They still refuse 60 cents to Chicago, though there are shippers ready to pay it. The fact is coal is coming in rapidly and shippers would like some tonnage to save them the necessity of stocking it and then picking it up again. The rate is pretty sure to be made. Vessel owners are trying to force a good rate by refusing to load at opening rates and thereby relieve the docks before a rate is made. They show their wisdom for once.

Capt. Dan McLeod, who is down from Detroit, reports that the decision to mention no vessels in the register this year unless their owners paid their tonnage dues was not carried out. Everybody but the underwriters who put through the foolish resolution knew that it couldn't be enforced. Still vessel owners are coming forward quite liberally and paying up. The Western Transit Company paid up this week. In a line of that size the amount makes a very pretty figure.

The move of the trunk lines to pool the grain brought by the lines to Erie and Buffalo is a very neat one, but it was born of desperatiom for all that. Such pulling and hauling, cutting and slashing as there has been was enough to force any kind of an agreement. It is stated quietly that if this plan succeeds the package freight, east-bound, will also be pooled.

There really seems to be hope for Oswego. If the Ontario & Western makes it a shipping point for hard coal as announced that will be one boost. It is reported that the Canadian steamer Seguin with the schooner J. B. Merrill and another consort to be picked up were chartered to carry lumber from Georgian Bay to Oswego at $2.75 for the season. The Ontario & Western is preparing to ship coal by lake from here, but hasn't any local plans perfected yet, or any coal here.

The friends of Capt. C. W. Brown, who know the terrible ordeal he has passed through in his long illness at Cleveland, will be pleased to learn not only that he is on his feet again, but has a boat to sail. When the Lehigh line appointments were made the Cayuga was left out as if for some such emergency as this. Capt. Brown, having been in the Northern line, he was well known to Manager Gordon, who now gives him the Cayuga to sail.

Bliss of Tonawanda has sold his raft towing tug Samson to the Perry Lumber Company of the Sault, where she will go into the same business. The price is not made public.

Plans for Elevators at Kingston and Prescott.

Special Correspondence to the MARINE REVIEW.

KINGSTON, Ont., March 30.—Not a few interested in marine matters believe that the withdrawal of the discriminatory canal tolls from grain vessels discharging in Kingston will be beneficial to Ogdensburg, hence there was no surprise when a Kingston paper announced that the Montreal Transportation Company was considering the advisability of placing a floating elevator at Prescott, Ont., across from Ogdensburg, and securing a portion of the trade. The rate from western points will be the same. Steamers can easily go down the river, but it is felt that schooners will still make Kingston the discharging port, as river navigation for sailing vessels is not free from dangers, and cargo insurance will be much higher than to lake points.

The capitalists interested in the elevator scheme for Kingston are pushing ahead. They have interviewed the government and asked that the site of the Tete Du Pont barracks, adjacent to the present quarters of the Montreal Transportation Company, be granted them, and an elevator to cost $150,000 will be reared. They have promised to give storage for grain for from eight to ten days free. Since the Kingston deputation has waited on the government the Prescott men who also talk of building an elevator have asked for the consideration of their claims.

Official Numbers and Tonnage.

The Bureau of Navigation, E. C. O'Brien, commissioner, reports official numbers and tonnage for new steam vessels on the lakes as follows: Selwyn Eddy, Port Huron, 2,846.14 tons gross, 2,164.11 net, No. 116,555; City of Kalamazoo, Grand Haven, 728.19 tons gross, 529.05 net, No. 126,949; C. A. Lorman, Detroit, 41.89 tons gross, 20.95 net, No. 126,948.

MARINE REVIEW for one year and Patterson's Nautical Dictionary for $6.

Appointments of Masters and Engineers.

Bradley, M. A., Cleveland, O: Steamers—New steel steamer, Capt. Joseph Holmes, Engineer W. W. Tyler; Gladstone, Capt. B. H. Jones, Engineer Harry Talbot; Hesper, Capt. Henry Peterson, Engineer Gilbo; Pasadena, Capt. L. Stough, Engineer Wm. Wilkie; M. B. Grover, Capt. Paul Surrett, Engineer Wm. Angel; City of Cleveland, Capt. C. Moran, Engineer L. Walley; Henry Chisholm, Capt. John Wysoon, Engineer Irwin Morrison; R. P. Ranney, Capt. Paul Howell, Engineer Albert Eggert; E. B. Hale, Capt. W. E. Morris, Engineer Michael Taylor; J. S. Fay, Capt. Robt. Kerr, Engineer R. S. Hanna; Fred Kelley, Capt. Thos. Delargie, Engineer S. F. Hunt; Superior, Capt. Chas. Ahlstrom, Engineer P. Lamar; S. E. Shelden, Capt. Chas. H. Tift, Engineer Gus. Helbing; new steamer building at West Bay City, Capt. M. Mulholand, Engineer C. M. Williams. Schooners—Adriatic, Capt. Harry Brock; A. Cobb, Capt. P. H. Smith; John Martin, Capt. N. Gifford; D. P. Rhodes, Capt. Geo. McLeod; Alva Bradley, Capt. Geo. Richards; Thomas Quayle, Capt. Robert Anderson; Sandusky, Capt. E. P. Spear; S. P. Ely, Capt. Arthur Wilson; Negaunee, Capt. L. C. Cole; M. R. Warner, Capt. W. B. Williams; S. H. Kimball, Capt. J. Bridge; Southwest, Capt. E. B. Smith.

Gilchrist, J. C., Cleveland, O.: Steamers—City of Genoa, Capt. J. L. Weeks, Engineer Wm. Mitchell; City of Naples, Capt. Geo. Bell, Engineer Chas. Sharp; John Craig, Capt. Chas. T. Gunderson, Engineer John J. Birney; A. P. Wright, Capt. C. C. Tousley, Engineer Thos. Bluett; R. E. Schuck, Capt. O. Olsen, Engineer Wm. Lawrence; J. C. Gilchrist, Capt. Henry Moody, Engineer John Parks; John B. Lyon. Capt. F. A. Bailey, Engineer Barney Wood; Cumberland, Capt. John Thompson, Engineer H. Stone; Columbia, Capt. J. E. Miles, Engineer C. N. Allbee; Hiawatha, Capt. J. C. Byers, Engineer Fred Fitzgerald; Oregon, Capt. Fred Goodell, Engineer Wm. Johnson; Waverly, Capt. Amos C. Reimers, Engineer Stephen Newnham. Schooners—H. D. Alverson, Capt. H. Gunderson; B. F. Bruce, Capt. W. H. Landgraff; W. L. Crosthwaite, Capt. Frank Perew; Verona, Capt. Philip Duroy; S. H. Foster, Capt. D. C. Sullivan; R. B. Hayes, Capt. J. P. Minskey; M. S. Bacon, Capt. John Farwell; T. P. Shelden, Capt. Horace Fisher; Michigan, Capt. Charles Olsen.

Anchor Line, Buffalo, N. Y.: Steamers—India, Capt. F. D. Osborne; China, Capt. C. Mason; Japan, Capt. H. Cronkhite; Gordon Campbell, Capt. James Niland; Philadelphia, Capt. A. E. Huff; Codorus, Capt. John McCarthy; Schuylkill, Capt. John Doherty; Mahoning, Capt. Chas. Christy; Susquehanna, Capt. M. Riley; Clarion, Capt. Joseph Corcoran; Lehigh, Capt. J. H. Berow; Alaska, Capt. M. Rowan; Lycoming, Capt. L. Wright; Conemaugh, Capt. H. O. Miller; Conestoga, Capt. Frank Bloom; Delaware, Capt. P. O'Neil; Juniata, Capt. D. Rider; Wissahickon, Capt. H. Durker.

Hart Line, H. W. Hart of Green Bay, Wis., Manager: Steamers—Fannie C. Hart, Capt. H. W. Hart, Engineer Charles Dennis; Eugene C. Hart, Capt. C. B. Hart, Engineer Richard Crandall; C. W. Moore, Capt. Ole A. Hansen, Engineer James Dunlap; Welcome, Capt. P. Rowlette, Engineer George Coulter.

Benham, C. E., Cleveland, O.: Steamers—Nahant, Capt. John Mullen; H. B. Tuttle, Capt. E. Detlefs; Pease, Capt. Thomas Sloan. Schooners—Queen City, Capt. Gabriel Knight; Richards, Capt. William P. Benham; Planet, Capt. Frank Parsons. Tug—C. E. Benham, unassigned.

Sloan & Cowles Excursion Line, Buffalo, N. Y.: Steamers—Puritan, Capt. Abner G. Gilbert; Pilgrim, Capt. John O'Brien; Gazelle, Capt. George Swift; Vision, Capt. Wright Taxter; Edwards, Capt. Louis Shalloe. Yacht—Alex. Sloan, Capt. Goorge Robinson.

Wex, Peter, Buffalo, N. Y.: Steamers—Inter Ocean, Capt. Peter Wex; Cormorant, Capt. Lawler. Schooners — Richard Winslow, Capt. Dennis Gallagher; Charles Wall, Capt. Winchester.

American Transportation Company, Fairport, O.: Steamers — Alex. Nimick, Capt. A. H. Reed, Engineer Charles Allenwood; John Harper, Capt. H. L. Mills, Engineer C. M. Stoddard.

White, W. J., Cleveland, O: Steamers—Britannic, Capt. Ira B. Mansfield, Engineer Wm. Eddy; Quito, Capt. Chas. H. Little, Engineer, H. W. Davis.

Canadian Steel Barge Company, Limited, Port Arthur, Ont.: Steamer—Algonquin, Capt. James McMaugh, Engineer Samuel Brisbon.

Port Arthur and Duluth Steam Packet Company, Port Arthur, Ont.: Steamer—Cambria, Capt. Peter Olson, Engineer H. O'Reilly.

Parker, C. L., Detroit, Mich.: Steamer—R. Martini, Capt. Thos. Van Stan, Engineer H. F. Rosenkrans.

Announcement of the transfer of the steamers Roswell P. Flower and Frank L. Vance from the Milwaukee Steamship Company, in which Capt. David Vance is a leading stockholder, to the Riverside Transit Company of Chicago, means simply that the owners of these boats are listing them for taxation at a place where municipal authorities do not compel vessel owners to pay sewer tax, school tax and levies of various kinds, of which they should bear no part.

A Comparative Statement.

In a neat pamphlet issued recently, the Almy Water Tube Boiler Company makes a statement of results obtained from the first boiler built by the company, and which replaced a return tubular boiler having two furnaces in the steamer Queen City. There were no changes made, except in the boiler, and the same engineer and fireman were in charge. The principal features of hull and machinery are: Over all, 107 feet; beam 18 feet, beam over guards, 24 feet; draught, 7½ feet; tonnage, 115 gross and 97 net; speed, 11½ statute miles per hour; engines 14 and 16 inches by 14 inches stroke; revolutions, 140 per minute; wheel 6 feet diameter by 8 feet pitch. The comparison is as follows:

1889. MARINE RETURN TUBULAR.	1890. ALMY'S PATENT WATER TUBE.
Square feet heating surface, 1,000.	Square feet heating surface, 700.
Square feet grate surface, 30.	Square feet grate surface, 30.
Weight of boiler, pounds, 22,000.	Weight of boiler, pounds, 12,000.
Weight of water, pounds, 11,000.	Weight of water, pounds, 2,000.
Number of trips, 205.	Number of trips, 248.
Length of trips, miles, 71½.	Length of trips, miles, 71½.
Total number of miles, 14,657½.	Total number of miles, 17,732.
Total coal consumed, tons, 408.	Pounds coal consumed per mile $48\frac{1}{15}$
Coal consumed per mile, lbs $55,\frac{67}{100}$	Saving in coal, 13.4 per cent.

In 1891 this steamer made 18,162 miles on 407 tons of coal. This is an average of 42½ pounds of coal per mile, including banking fires. In 1892 the miles run was 17,732, and the coal used was 373½ tons.

Another Sub-Marine Boat.

An eastern exchange is responsible for this description of a sub-marine boat being built by James F. Buckley of Haverhill, Mass., for exhibition at the World's Columbian Exposition: "The boat is of the cigar shape, 21 feet long and five feet in diameter at the largest section, and on the inside of this shell hangs a cradle, 15 1-2 feet long on points carrying the burden, machinery, operator and ballast, and also an eclectric engine of 3 horse-power, from which the outside shell will be made to revolve rapidly, and this shell, being clothed with fins, will dart through the water with fish-like speed. The stern has three distinct movements, one that allows the hull to rotate, another to steer the craft by, and the third to drive a small propeller, which is only used when making a landing or taking in air, when the hatchway is open. The air is furnished from two long copper tanks, when the boat is under water, and when on the surface there is a suction pipe through a stationary portion of the stern. The shell has one section of heavy plate glass, giving a clear vision from the interior when in motion. The last model made by Mr. Buckley is driven by a spring motor, and will show a speed of 30 miles per hour for a short distance, and he claims that much better speed can be obtained by the large model."

Not a Probable Consequence of Collision.

The schooner John H. May, bound from New York to Jacksonville, Fla., was injured by a collision, occurring without her fault, while at anchor in the mouth of Chesapeake bay, and was compelled to put into Norfolk for repairs. After the repairs were made she again started on her voyage, but before reaching the place of collision was compelled, by bad weather, to put back to Hampton Roads, where she was detained by the storm for several days. Judge Butler, of the U. S. District Court, eastern district of Pennyslvania, held that she was not entitled to damages for this detention, as it was not such a probable consequence of the collision as might have been foreseen.

The Eagle Lubricator Company, No. 108 Canal street, Cleveland, O., gives an illustration of its Globe automatic injector on another page, and makes a very fair offer to all who are seeking an injector that combines simplicity with maximum capacity and durability. They will send to any such person on trial a Globe injector or ejector, and will guarantee its successful operation. Since the Globe injector was patented in April, 1892, several thousand have been sold and none have been returned to the factory. The points of superiority claimed for this iujector, are that it has only one valve to operate, and will restart itself if the feed is broken. Its capacity can be graded down to 40 per cent, according to requirements, and it is warranted to lift from 15 to 20 feet. It can be taken apart and cleaned with an ordinary wrench. Send for a catalogue.

In General.

The Hubbard Coal Company, Sandusky, O., has issued a small chart showing the new straight channel in Sundusky bay. It was reproduced from a drawing made in the United States engineer's office, thereby insuring correctness. If you will apply at once and mention the REVIEW you will probably be favored with a copy.

As a striking illustration of the great depreciation which has come over shipping property of late, Fairplay of London states that there is just now lying idle in a northern port a fine spar-decked steamer of 4,500 tons, built last year on the Clyde at a cost of £35,000, which is being offered for £25,000. There are about 300,000 tons of shipping lying-up in the ports from Blyth to the Tyne.

The steamship Naronic, supposed to have been lost through striking an iceberg or a derelict in the North Atlantic, was one of the best freight steamers in the Atlantic trade, having been built only last year by Harland & Wolff of Belfast. She was 470 feet long, 53 feet beam and 35½ feet deep, and her gross tonnage was 6,000. She had twin screws and triple expansion engines of 4,000 horse power.

There is one maiden that will not wear crinoline this year. That is the summer girl who brightens the eyes of the sea side sojourners with her natty nautical costume and gladdens the heart of the yachtsman who has the honor of her graceful presence on his boat, be it catboat or steam yacht. She is breezy, delightful and full of all sorts of misinformation about the sea. But she is pleasant to look upon and makes evident why a vessel is always named in the feminine gender.—Maritime Register.

J. H. Ladew of New York city has contracted with the William Cramp & Sons Ship and Engine Building Company for a steel steam yacht, guaranteed to make eighteen knots an hour. In the event of the yacht's failure to make this speed the contractor will be under no obligation to accept her. The vessel will be registered in the New York Yacht Club. The contract calls for a vessel 185 feet over all, 23 feet beam, and 15 feet depth of hold. The engines will be of the triple expansion type. The deck houses will be of iron covered with teak throughout.

The Carnegie Steel Company has ordered a new press for its armor plate works at Homestead Pa.—an enormous piece of machinery that will cost over $1,000,000—from Whitworth & Co., of Manchester, England. It will be the largest piece of machinery of the kind in this country, and perhaps in the world. The press will have a capacity of 16,000 tons. The machine will arrive by the first of next year. It is said that by the aid of this machinery the company will be able to make the greatest forgings in the world, and a plate of 200 tons can be worked in one piece.

A most terrible thing to encounter in mid-ocean is a tidal wave. By causes not fully understood a mountain of water rears itself to tremendous heights, and moves with the velocity of a railway train. There is no possibility of getting around, or out of the way of it, and a vessel so unfortunate as to encounter a tidal wave must go through it. The shock is fearful, and the chances for survival are very slight. The tidal wave presents a solid front like a wall, and no vessel can ride it, but must plunge through. In any case the damage is very great; boats are swept away and every fastening started. Ships have been dismasted and left wrecks by tidal waves, and many have been lost while encountering them.—The Engineer, New York.

ST. MARY'S RIVER CHARTS NOS. 1 AND 2 FROM POINT IROQUOIS TO E. NEEBISH AND FROM MUD LAKE ENTRANCE TO E. NEEBISH, CORRECTED TO AUG. 30, 1892, CAN BE HAD AT THE OFFICE OF THE MARINE REVIEW, 516 PERRY-PAYNE BUILDING, CLEVELAND, FOR 20 CENTS EACH, OR BOTH BY MAIL FOR 50 CENTS. BOTH CHARTS WILL BE FURNISHED WITH CLOTH BACKS AND BOUND EDGES FOR $1.

A PUBLIC MEETING OF THE BOARD OF Engineer Officers designated by Special Orders No. 7, Headquarters Corps of Engineers, in accordance with joint resolution of Congress, approved February 3, 1893, directing the Secretary of War to investigate the subject of ratt towing on the great lakes and their connecting waters, will be held at the U. S. Engineer Office, 34 West Congress street, Detroit, Mich., at 10 a. m., April 6, 1893. All persons interested are invited to present their views in regard to the matter in writing, in duplicate, either in person or by mail. 9-16-23-30

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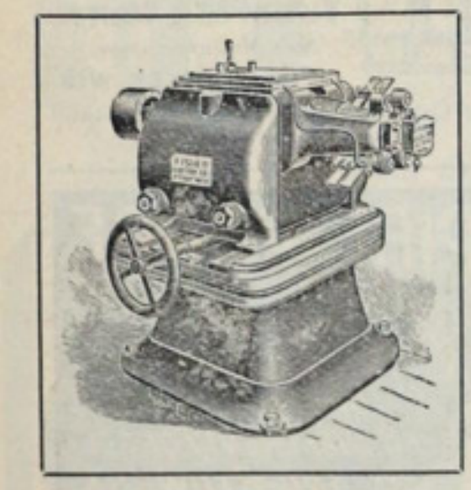

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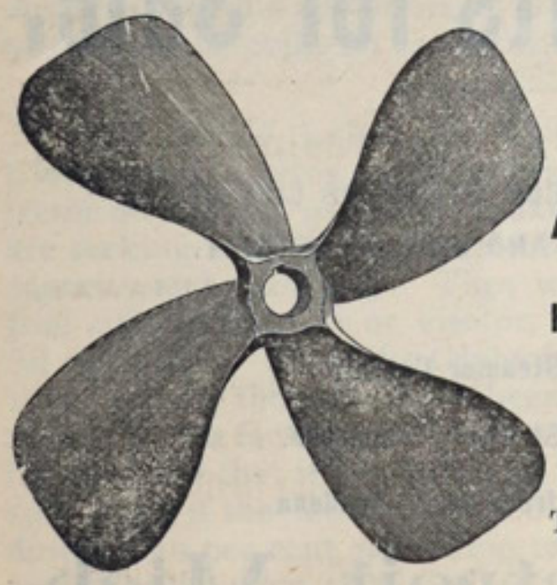

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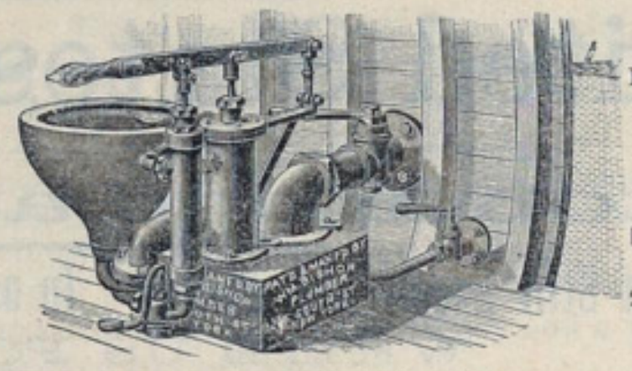

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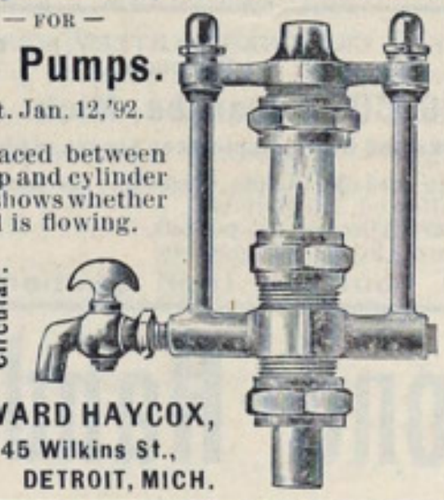

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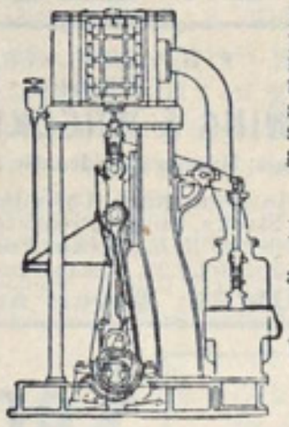

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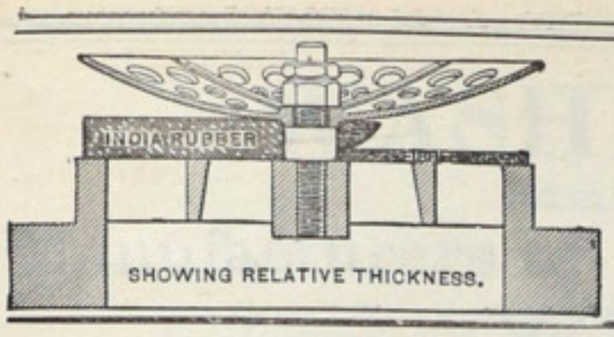

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UNITED STATES ENGINEER OFFICE, 34 West Congress Street, Detroit, Mich., March 18, 1893. Sealed proposals for turbine power plant for the 800-foot lock, St. Mary's Falls Canal, Mich., will be received at this office until 2 p.m May 2, 1893, and then publicly opened. Specifications, blank forms, and all available information will be furnished on application to this office. O. M. POE, Colonel, Corps of Engineers, Bvt. Brig.-Gen. U. S. A. 23-30-6-13

U. S. ENGINEER OFFICE, GRAND RAPids, Mich., March 9, 1893. Sealed proposals for furnishing and delivering materials (timber, stone, iron, etc.,) at the harbors of Manistee, Grand Haven and South Haven, Mich., will be received at this office until 10 a. m., on Friday, the 7th day of April, 1893, and then publicly opened. Specifications, blank forms, and all available information will be forwarded on application to this office. WILLIAM LUDLOW, Major, Corps of Engineers, Bvt. Lieut., Col. U. S. A. 23-30

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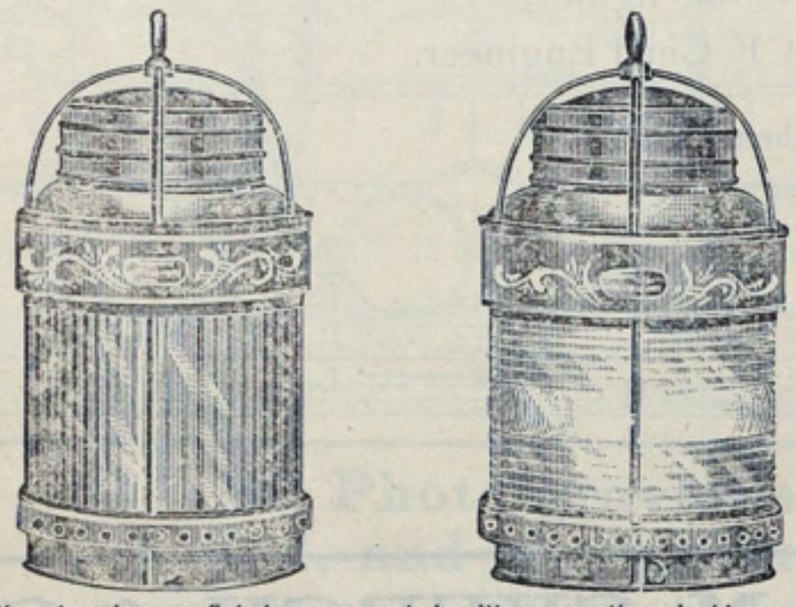

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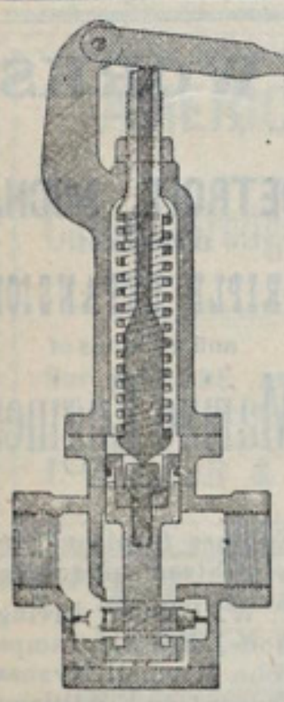

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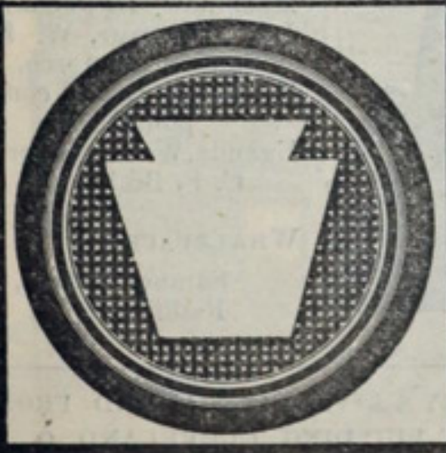

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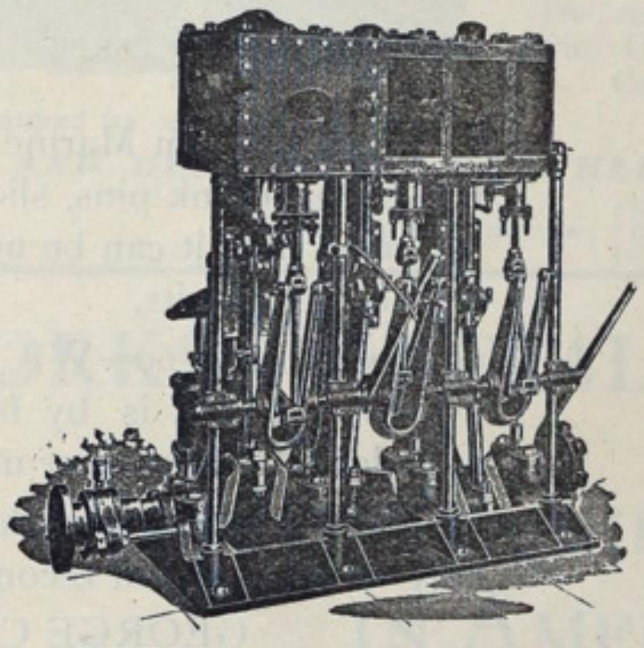

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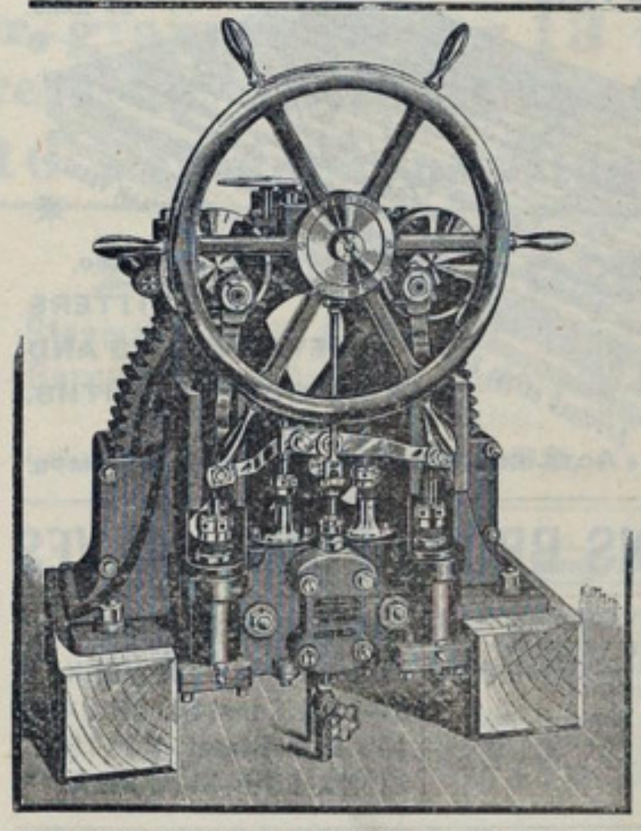

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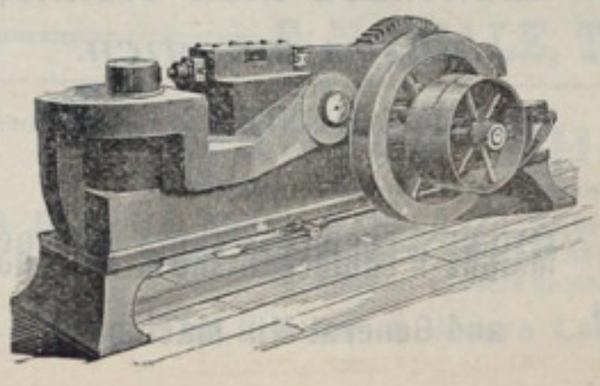

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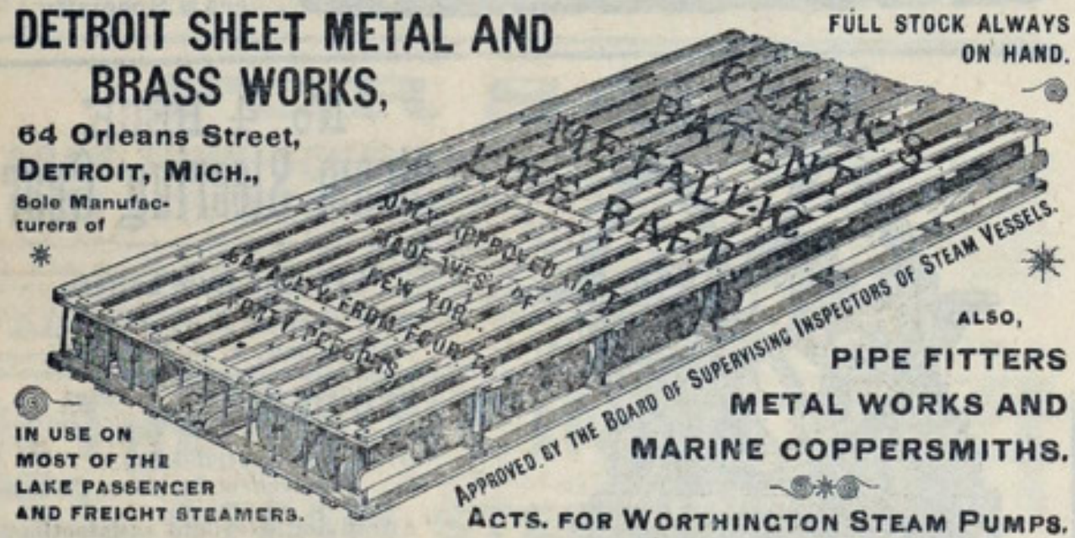

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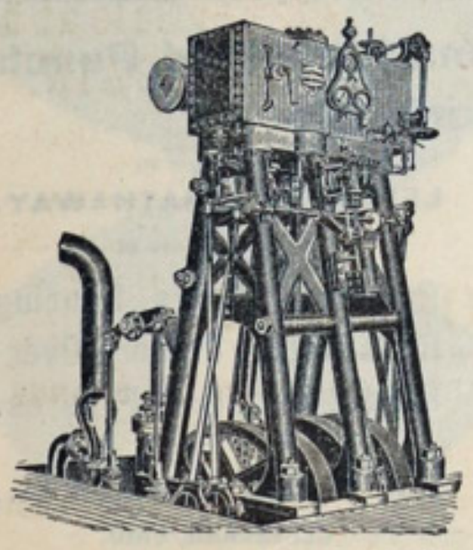

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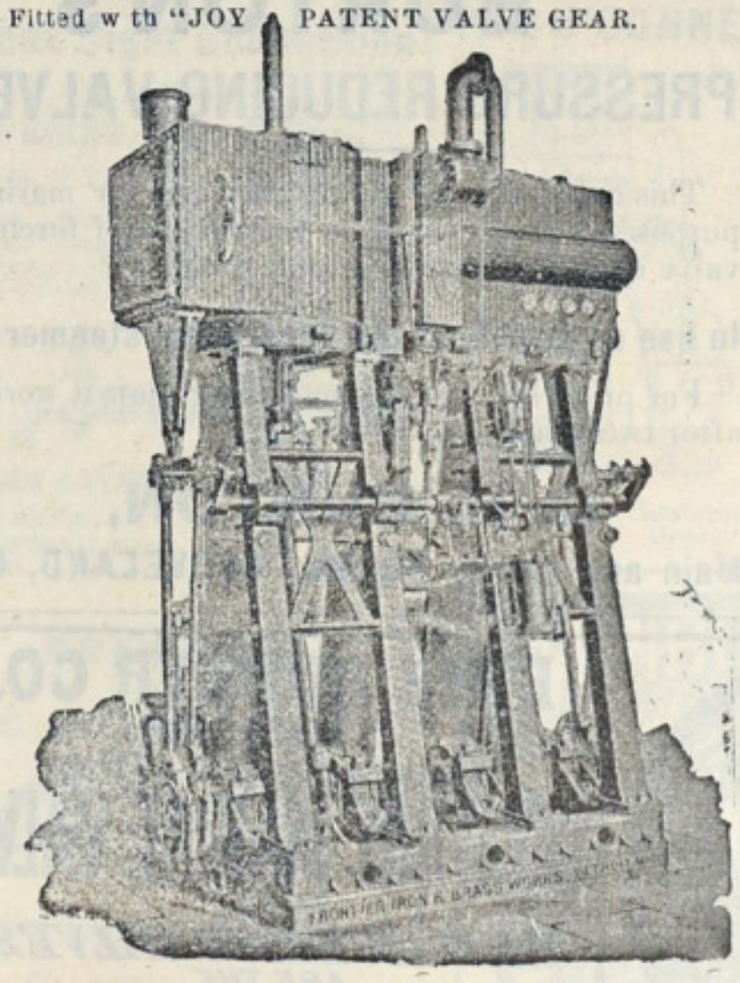

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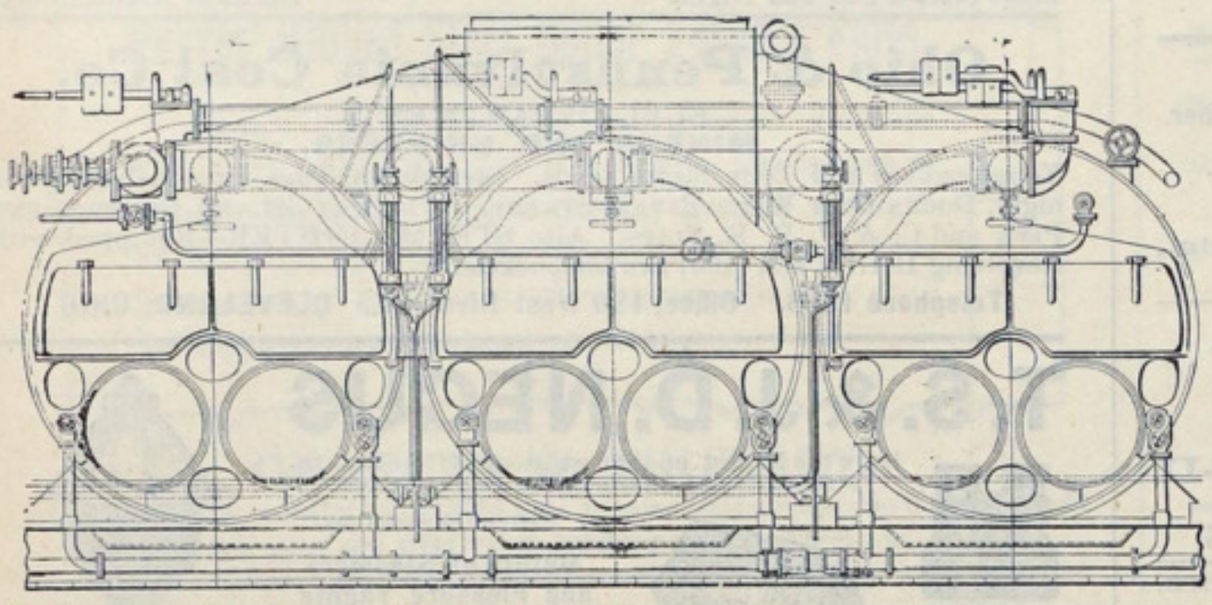

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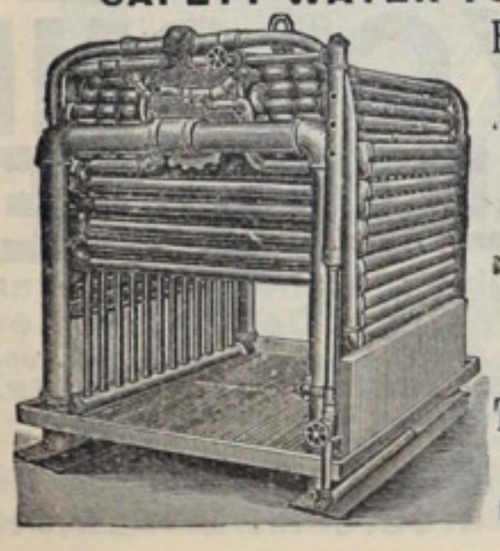

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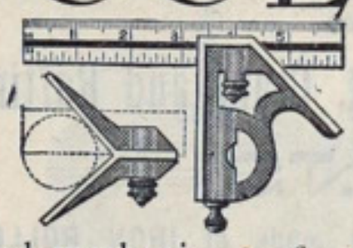

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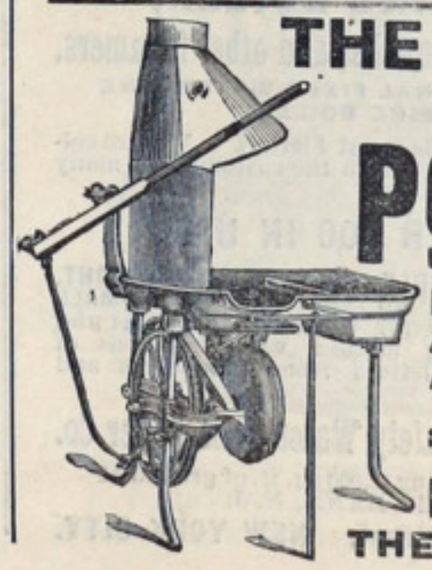

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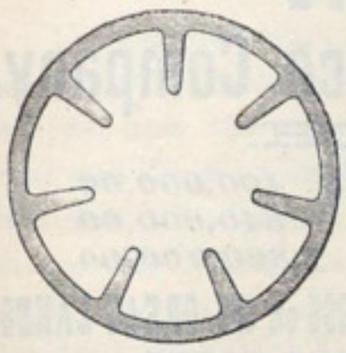

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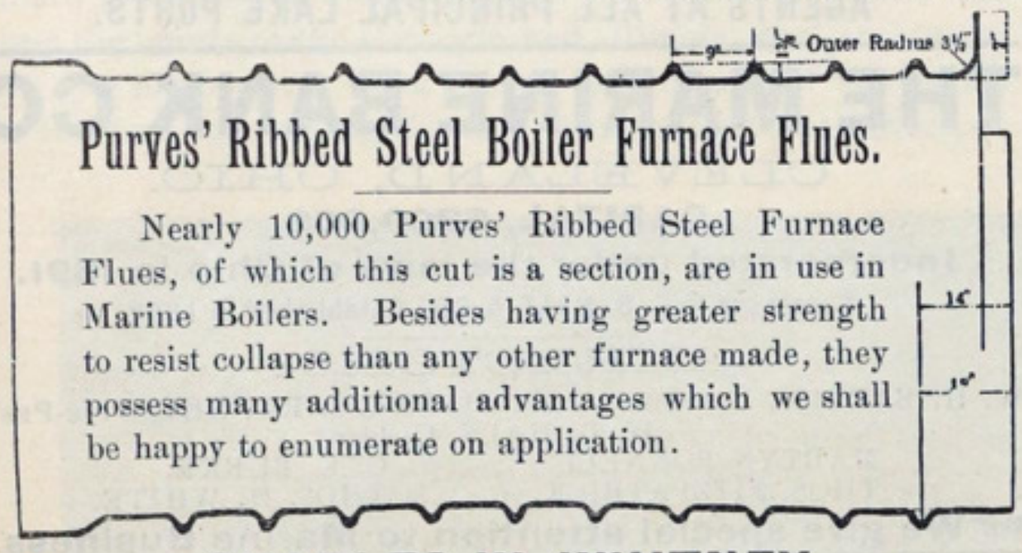

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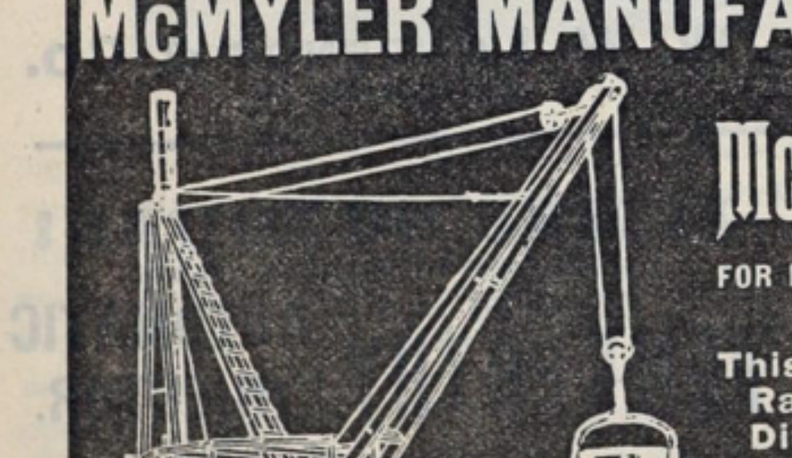

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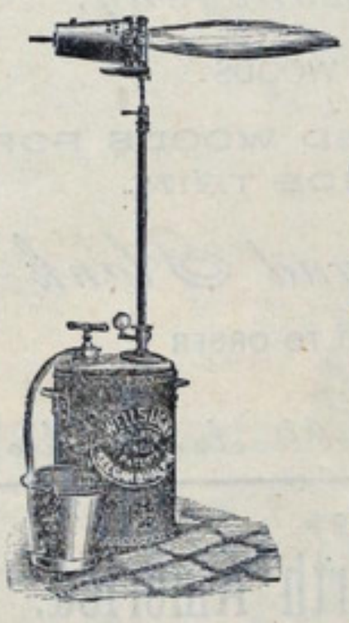

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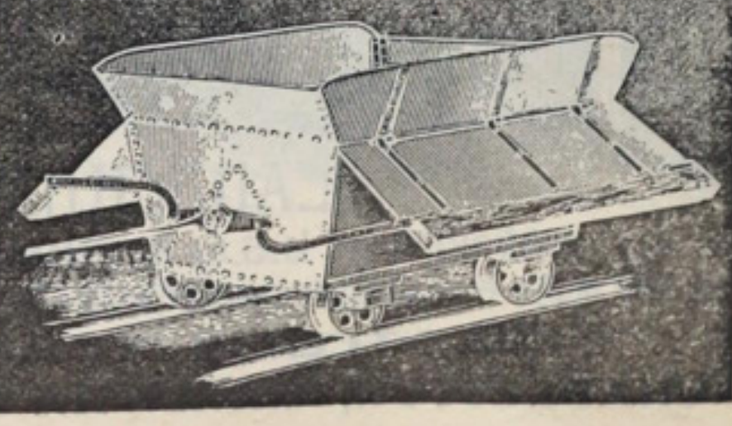

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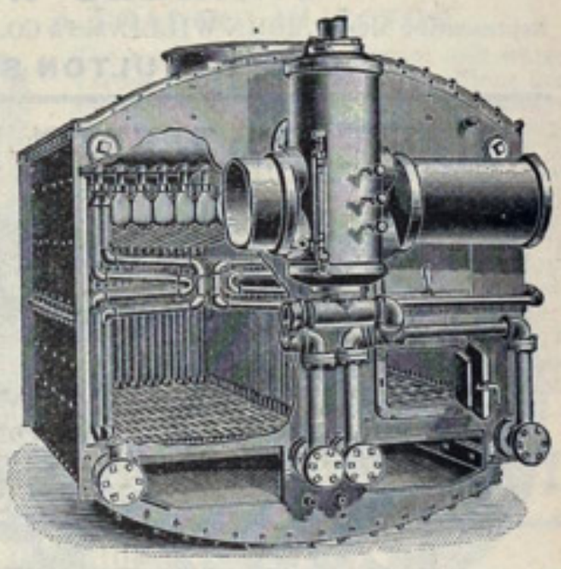

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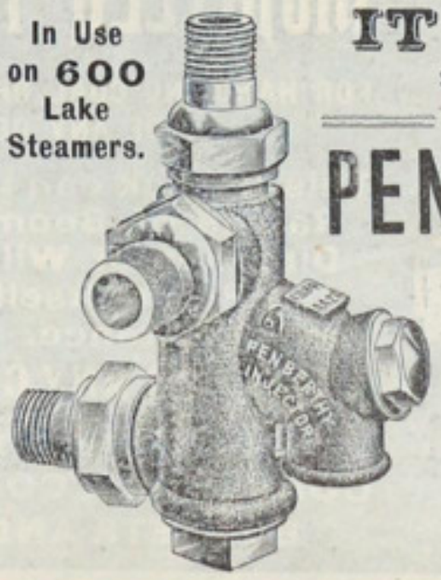

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